

1 TRAFFIC AND CAPACITY MODELING PROCESS

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3 Background of the Invention

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5 The present invention relates to telecommunications
6 management systems and, more particularly, to an enhanced
7 traffic and capacity modeling process or tool for tracking
8 traffic levels, and particularly traffic peaks, to
9 facilitate planning for equipment and service growth.

10 Telecommunications facilitate the interactions which
11 are necessary or desirable for many aspects of modern life,
12 including business affairs, personal relationships,
13 education, government functions, entertainment, and the
14 like. Telephone systems function to establish a temporary
15 electronic communication channel between a caller and a
16 called party. A temporary communication channel, or call,
17 is generally established between telephone lines of the
18 communicating parties through "switches" which establish the
19 particular channel and multiple line trunks which carry the
20 communication signal between switches. The number of calls
21 which can be simultaneously accommodated is limited by the
22 number of switches and trunk lines available, that is, the

1 total number of functioning switches and trunk lines in
2 existence which are not currently occupied with calls or
3 other "traffic".

4 Traffic on communication networks can include signals
5 carrying actual vocal conversations between humans, as well
6 as data such as communications among distributed computer
7 systems, electronic financial transactions, facsimile
8 signals, internet "surfing", email exchanges, network
9 housekeeping data, and the like. New telecommunications
10 technologies are emerging which will make further use of
11 network throughput, such as on-line commerce, video
12 teleconferencing, on-demand video entertainment,
13 transmission of high quality medical images, remote control
14 and monitoring applications, and the like.

15 Network traffic varies over time and date and by
16 locality. Economics prevent network operators from
17 providing even remotely sufficient capacity for all users to
18 access the network simultaneously, since a large proportion
19 of such capacity would be idle most of the time,
20 constituting a wasted investment. In practice, telephone
21 network operators attempt to provide adequate capacity to
22 accommodate peak traffic, with some spare capacity to take
23 care of unexpected traffic peaks, temporary local service
24 outages, and short term growth. Operators of networks

1 attempt to make the best use of existing capacity by
2 efficient balancing of traffic loads through available
3 switches and trunks by means of selective routing of calls.
4 Because of the importance of activities supported by
5 telecommunications and the volume of traffic,
6 telecommunications network operators strive to maximize "up
7 time" for components of the network as well as the
8 technological quality of communication signals.

9 In the past, telephone network operators have typically
10 analyzed usage data, derived from billing data, on a monthly
11 basis for purposes of planning growth of infrastructure and
12 service. Although a monthly accumulation of data has
13 utility in planning service expansions and upgrades, the
14 data does not show the volume of day-by-day traffic, much
15 less hour-by-hour traffic peaks. A monthly total for a
16 given customer does not show when, and to what extent, call
17 peaks have occurred. At best, planners can make an educated
18 guess at daily and hourly averages.

19 Certain types of businesses have high levels of
20 incoming phone calls, such as companies which market
21 products by telephone orders, companies which operate
22 customer support services, certain government agencies, and
23 the like. In order to effectively operate such services,
24 such companies employ large numbers of phone lines to which

1 are routed calls placed to one or more published telephone
2 numbers, such as "800" type numbers. Such a technique is
3 referred to as a dialed number identification service
4 (DNIS). To serve their customers competitively, such
5 companies may set answering goals, such that a customer's
6 call will be answered within a certain number of rings. In
7 order to meet such a goal, it is necessary to route the
8 calls efficiently to available operators and to time the
9 connection properly so that the customer's perception of
10 prompt response is met. This further requires an adequate
11 number of phone lines to handle the peak number of calls, an
12 adequate number of operators properly trained, and call
13 processing hardware and software.

14 The call processing hardware and software is most
15 typically operated by a telephone network operator, or
16 telephone company. Management of such calls is typically
17 handled by a call processing "platform" which provides
18 hardware for routing the calls and which records call data
19 for billing purposes. The billing information is referred
20 to as call detail records (CDR's) and, for toll-free type
21 operations, include records of call attempts and usage
22 minutes to each dialed number or DNIS. The CDR's are
23 accumulated over a month for billing to the client company.
24 In the past, capacity planning, both for the client company

1 and for the telephone network, has been based on such
2 monthly accumulations of recorded use. However, as
3 explained above, a monthly record can be a very coarse tool
4 on which to make planning decisions, since peak daily or
5 hourly usage may greatly exceed a daily or hourly average of
6 the month's usage.

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Summary of the Invention

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10 The present invention provides a traffic and capacity
11 modeling process which is capable of detecting hourly and
12 daily peaks of usage of toll-free dialed numbers. The
13 modeling process accesses call processing platforms and
14 copies call detail records or CDR's into a CDR collection
15 database. Periodically, such as once per day, the CDR
16 collection database is processed to aggregate selected sets
17 of CDR data fields or call parameters by DNIS for the date,
18 hour, and call processing platform. The aggregated CDR
19 parameters are then stored in tables for a period of time,
20 such as a year or more, to enable access and analysis for
21 planning purposes. Analysis of the aggregated CDR
22 parameters may include graphic plotting, entry into
23 spreadsheets, and the like. Of particular interest are the
24 total number of attempts to call a particular DNIS per hour

1 and the total usage minutes for a particular DNIS per hour.
2 Variations in these parameters over time reveal peaks of
3 usage of a given DNIS or dialed number and, thus, give a
4 better indication of the adequacy of the number of lines,
5 operators, and the like associated with a given DNIS than
6 analysis based on conventionally monthly usage totals.

7 The aggregated CDR tables provided by the modeling
8 process of the present invention can be made available for
9 network operations purposes to allow planning for load
10 balancing for expected peaks in calls by the hour, day, or
11 season of the year and by location. For long term network
12 planning, the aggregated CDR records provide accurate
13 indications of peak call usage not only by time, but also by
14 origin and destination of the calls. The information
15 provided by the present invention can be used by
16 telecommunications marketers to assist their client
17 companies in optimizing their acquisition of equipment and
18 services, as well as in allocating and training their
19 personnel. Telecommunication network operators can also use
20 the information provided by the present invention to
21 optimize the performance of their equipment and operations.

22 The drawings constitute a part of this specification,
23 include exemplary embodiments of the present invention, and
24 illustrate various objects and features thereof.

1 Brief Description of the Drawings

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3 Fig. 1 is a simplified block diagram illustrating
4 components involved in a traffic and capacity modeling
5 process which embodies the present invention.

6 Fig. 2 is a simplified flow diagram illustrating
7 principal steps of the traffic and capacity modeling
8 process.

9 Fig. 3 is an exemplary table illustrating hourly call
10 parameters of a selected dialed number created by the
11 traffic and capacity modeling process.

12 Fig. 4 is a line graph illustrating a variation of
13 hourly usage minutes of a selected dialed number which was
14 created using the traffic and capacity modeling process.

15 Fig. 5 is a line graph illustrating a comparison of
16 hourly usage minutes for a pair of call processing platforms
17 which was created using the traffic and capacity modeling
18 process of the present invention.

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20 Detailed Description of the Invention

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22 As required, detailed embodiments of the present
23 invention are disclosed herein; however, it is to be
24 understood that the disclosed embodiments are merely

1 exemplary of the invention, which may be embodied in various
2 forms. Therefore, specific structural and functional
3 details disclosed herein are not to be interpreted as
4 limiting, but merely as a basis for the claims and as a
5 representative basis for teaching one skilled in the art to
6 variously employ the present invention in virtually any
7 appropriately detailed structure.

8 Referring to the drawings in more detail:

9 The reference numeral 1 generally designates a traffic
10 and capacity modeling process which embodies the present
11 invention. The process 1 generally accumulates call detail
12 records 3 and aggregates totals of selected call parameters
13 generated over relatively short intervals of time for each
14 DNIS or dialed number to thereby create tables of aggregated
15 data by DNIS which can be meaningfully analyzed to assess
16 the peak usages of such dialed numbers and the adequacy of
17 equipment and personnel supporting and responding to calls
18 to such dialed numbers.

19 The process 1 is particularly applicable to analyzing
20 traffic patterns of calls to entities which make use of toll
21 free numbers, such as "800" type numbers. Often, an entity,
22 such as a marketing company or a customer support operation
23 of a company, will publish an 800 XXX-XXXX number for
24 inbound calls for merchandise orders or customer support

1 assistance. Such a company will lease a number of telephone
2 lines, and calls dialed to the published toll free number
3 are routed to one of these lines on a first-available basis.
4 Such a technique is referred to as a dialed number
5 identification service or DNIS. A company using a DNIS pays
6 for the number of lines in service and the total minutes of
7 usage of the lines. To avoid lost sales, marketing
8 companies try to avoid unanswered calls or busy signals.

9 Thus, there is a necessary balance between the expenses of
10 acquiring and staffing any number of incoming lines and the
11 potential of lost sales if the call facilities are
12 overloaded. The process 1 aids in achieving such a balance
13 by providing tools to determine the times and levels of peak
14 usage of DNIS operations.

15 Referring to Fig. 1, calls to DNIS numbers are handled
16 by call processing platforms 10 which collect call
17 parameters which are written to call detail records 3 or
18 CDR's. Each platform 10 is a computer or system of
19 computers executing proprietary software to accomplish its
20 function, which is to collect the CDR's 3 for billing
21 purposes. Either a single call processing platform or
22 multiple platforms 10 can be employed depending on the
23 volume of call traffic and the processing power of the
24 particular platform 10.

1 The process 1 copies the CDR's 3 from the platforms 10
2 into a single database or multiple databases 15 which may be
3 dedicated individually to the specific call processing
4 platforms 10. Periodically, such as once a day, the
5 databases 15 are accessed by the process 1 and selected call
6 parameters of the CDR's 3 are aggregated according to DNIS
7 by hour and platform and stored in aggregated tables 18.

8 The aggregation of the CDR parameters into the tables 18
9 greatly compacts the storage volume that would be occupied
10 by the original CDR's 3 and converts certain call parameters
11 of interest to a form which is usable for assessing the
12 levels of traffic through the DNIS numbers and the adequacy
13 of response to the call traffic by the network customer.

14 Fig. 2 summarizes the principal steps of the process 1
15 of the present invention. At step 20, the process 1
16 periodically accesses the call processing platforms 10 and
17 copies the CDR's 3 to the CDR databases 15 at step 22. On a
18 longer time cycle, preferably once a day, the process 1
19 extracts selected sets of call parameters from the CDR's 3
20 in the databases 15 at step 24 and, at step 26, aggregates
21 the sets of call parameters for each DNIS by date, hour, and
22 call processing platform 10. The process 1, thus, adds up
23 the duration of each call and the total number of call
24 attempts to each DNIS for a given hour, day, and platform

1 10. Alternatively, other call parameters could be
2 aggregated. The aggregated sets of call parameters are
3 stored in the tables 18 at step 28 and may be analyzed at
4 step 30, as by graphically plotting variations in the
5 parameters, entry into spreadsheets, or the like.

6 Fig. 3 illustrates an exemplary table 18 of aggregated
7 call parameters for an exemplary DNIS 34, represented as
8 (800) XXX-3474. The table 18 lists total duration 35 of
9 accumulated calls to the DNIS 34 in minutes and the total
10 number of attempts 37 to call the particular DNIS, by hour
11 39 and platform 41 throughout a particular date 43.

12 Fig. 4 illustrates a line graph with a curve 48 showing
13 total duration of usage 35 of DNIS 33 by hour over a
14 particular date, which is different from the date set shown
15 in Fig. 3. The curve 48 dramatically indicates the
16 variation of usage of DNIS 33 throughout the day. The
17 traffic level diminishes during middle of the night hours,
18 ramps up during the morning and afternoon hours, and peaks
19 at 50 in the evening hours. A simple average based on a
20 total month's usage of DNIS 33 would not detect the evening
21 peaks 50. Phone lines leased and staffed based on a monthly
22 average of usage of a DNIS 33 might be inadequate for the
23 traffic peaks 50. The graphic analysis provided by the
24 process 1 enables the network operator to accurately

1 estimate the peak usage of a given DNIS, so that the network
2 operator can more effectively market its products and
3 services and so that a network customer can obtain adequate
4 and economical levels of network services and staff them to
5 handle the expected peaks of activity.

6 Fig. 5 is a line graph illustrating a pair of curves 55
7 and 57 showing total duration of all calls processed by call
8 processing platforms B and V by hour, throughout a day. The
9 data plotted in Fig. 5 was generated using the process 1.
10 The curves 55 and 57 show the variation in traffic by hour
11 throughout a day. The process 1 can be used not only for
12 analyzing the service needs of the network customers, but
13 also for assessing the capacity and adequacy of network
14 equipment, such as call processing platforms 10.

15 The tables 18 and other data generated by the process 1
16 is preferably archived for a period somewhat greater than a
17 year. This allows comparisons of traffic levels for network
18 customers and the network by hour, day, week, and month over
19 an entire year and a complete cycle of seasons. This allows
20 for long term planning of customer and network needs. The
21 tables 18 and other data generated by the process 1 is much
22 more compact and organized than the original CDR's 3, such
23 that storage requirements are reduced. The tables 18 can be

1 purged on a regular schedule to enable new data to be
2 stored.

3 After some history of the data has been established
4 using the process 1, usage patterns at the individual
5 network customer and industry level will develop to allow a
6 "what if?" analysis capability which marketing and capacity
7 planning components of a network operator can use After the
8 historical data is loaded, and DNIS and cyclical patterns
9 have been established, the historical data can be used to
10 forecast future customer needs. Most customers will fall
11 into one of a limited number of customer profile segments.
12 Such segments may include government service, help desk
13 operations, insurance companies, colleges, and the like.

14 Because of this segmentation and with knowledge of the
15 historical usage patterns, network marketing groups will
16 have the ability to analyze a prospective customer's
17 expected traffic volume with just a projected total monthly
18 minutes and/or number of calls figure. The process 1 allows
19 the customer to select a customer segment which best fits
20 their industry, select an expected total monthly minutes or
21 calls quantity along with a month-to-month growth pattern,
22 and display a tabular or graphical representation of the
23 expected: daily usage minutes by hour; daily calls by hour;

1 and the expected daily usage pattern, complete with expected
2 volume at a busy hour.

3 A network capacity planning group can apply this same
4 analysis scenario, since traffic volumes by usage minutes
5 can be effectively translated into network port
6 requirements. Since the historical data depicts the
7 platform ports and minutes available, a network marketing
8 group can aggressively pursue customers whose expected
9 calling patterns occur at non-peak times of the platforms.
10 The process 1 also increases the efficiency of capacity
11 planning efforts, since forecasted growth recognized at
12 early time frames enables the acquisition of new and
13 upgraded equipment in a timely fashion.

14 It is to be understood that while certain forms of the
15 present invention have been illustrated and described
16 herein, it is not to be limited to the specific forms or
17 arrangement of parts described and shown.

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